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Investigating environmental and microbial drivers of hydrogen uptake in UK peatlands

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Uptake of hydrogen from the atmosphere by microbial activity in soils is the main global H_2 sink mechanism. The processes and environmental drivers which modulate the H_2 soil sink are highly uncertain, but research has demonstrated that moisture, soil porosity and temperature affect the magnitude of H_2 uptake by soil microbes. Peatlands are carbon-rich, dynamic environments with a fluctuating water table and temporal seasonal variation. These environments harbour a relatively large capacity for microbial activity but also contain a variety of mixed environments and microtopography (hummocks and hollows). There are no dedicated studies reported in literature exploring H_2 flux dynamics in peatlands to date.

To investigate the drivers of H_2 flux in peatland environments, in-situ field measurements of H_2 flux have been carried out using the flux chamber method at two Scottish peatlands. Auchencorth Moss (AC) and Whim Bog (WH) are located within the Pentland region south of Edinburgh. AC was previously drained, with peat depth at the study site between 0.5 - 1 m, whereas WH has been left in its natural state with peat depth ranging between 3 - 6 m. At each site, chambers were placed to capture variation in H_2 flux due to microtopography. Water table depth and temperature measurements were taken at each chamber at each measurement occasion. Initial results show that mean H_2 flux in autumn and winter were -21.5 nmol m^{-2} s^{-1} at AC and -18.5 nmol m^{-2} s^{-1} at WB.

As well as in-situ field studies, lab-based incubations using soil samples from AC and WH have been conducted to investigate H_2 flux under controlled moisture conditions to identify optimum conditions for uptake. Analysis is being carried out using DNA sequencing to identify the microbial species responsible for H_2 consumption in samples. Molecular sequencing will also explore the abundance of the gene which activates the expression of the hydrogenase enzyme under varying moisture levels to infer the favourable environmental conditions for H_2 uptake on a microbial scale. We hope to report preliminary results at EGU. The main aim of this work is to assess the strength H_2 soil sink in high carbon landscapes such as peatlands and explore the key environmental and microbial drivers that constrain H_2 uptake.